

# INTERACTIVE EQUIPMENT DIAGNOSTIC AND ORDER WRITING SYSTEM

## FIELD OF INVENTION

The present invention relates generally to interactive computerized systems and methods for obtaining and processing information. More particularly, the present invention pertains to an interactive system and method for receiving information regarding a customer, the equipment, such as an automobile, a tractor and/or trailer, a fork lift, cherry picker or front loader, and the service or repairs it needs, and the processing of this information to generate work and parts orders for the customer, parts. Supplier(s) and mechanic. The invention further pertains to the optional transmission of work completion data to accounting and/or quality control subsystems. While the invention is usable for servicing a variety of equipment, it will be primarily described here in terms of automobiles because the description of this example addresses most, if not all, of the problems relative to a large repair shop for such equipment.

## BACKGROUND OF THE INVENTION

Dropping off equipment at a dealership or repair shop for service can be a time-consuming and frustrating activity. Even though such organizations may open as early as 7 a.m. and stay open until 6 p.m., or so to accept equipment for service, these hours are not always long enough to accommodate all customers. Consequently, some customers find it necessary to drop their equipment off during

1 the hours the service centers are closed. With automobiles, for example, the driver  
2 usually leaves their keys in an envelope upon which they write the observed  
3 problems and request service. Appliances would be put into a cubicle, which locks  
4 on closure after the owner has filled out a problem description. In such instances,  
5 the complete situation is not always communicated effectively. Even when the repair  
6 shop is open, the customer may need to wait quite some time to provide the  
7 necessary information to a service manager or other representative, creating further  
8 delays. This process is improved using the modern computer technology of this  
invention.

The present invention provides an interactive, user-friendly-diagnostic system  
for the driver or other equipment deliverer. The customer can answer basic Menu-  
driven queries and/or prompts and the system will prepare and transmit to the repair  
center a preliminary diagnostic report such as hard starting in the cold - never  
happened before. The system is particularly useful for employment outside the  
normal operating hours of the repair facility.

Representative of the art is;

17 U.S. Patent No. 5,214,582, issued to Gray, teaches interactive diagnostic  
18 systems and methods for automotive vehicles of the type having networks Of  
19 sensors and actuators for sensing and actuating various functions in the vehicle and  
20 onboard computers for monitoring sensors and controlling the actuators. An external  
21 computer is used to control selected actuators independent of the onboard computer  
22 and for simulating operation of selected sensors. At the same time, the electronic

1 data entering and exiting the onboard computer is monitored and analyzed by the  
2 external computer for trouble shooting purposes.

3 U.S. Patent No. 5,513,107, issued to Gormley of Ford Motor Co., teaches  
4 methods and apparatus for controlling operating subsystems of motor vehicles.  
5 Diagnostic and maintenance services for the vehicles are provided by monitoring  
6 various operating subsystems connected to a vehicle controller and recording  
7 diagnostic data. Such data can be periodically communicated to a service center  
which determines the service(s) needed and communicates there conclusions back  
to the vehicle controller where it is displayed to the vehicle operator.

U.S. Patent No. 5,557,268, issued to Hughes et al. of Exxon, teaches an  
automatic vehicle recognition and customer automobile diagnostic system. Each  
vehicle includes a transponder that transmits an rf code so that vehicle diagnostic  
measurements made upon entry to the service facility can be associated with the  
specific vehicle and displayed to the customer in their service area.

U.S. Patent No. 5,058,044, issued to Stewart et al., teaches a system for  
automatically identifying vehicles assimilating data from the identified vehicle,  
correlating the data with predetermined data and providing a statement of account  
18 for a transaction involving the vehicle. A service record for the vehicle is prepared  
19 by the system for use in connection with such transactions. Data for the service  
20 record is provided primarily by onboard sensors, but may be augmented by data  
21 submitted via an onboard keyboard.

1 U.S. Patent No. 4,602,127, issued to Neely et al., teaches a vehicle  
2 diagnostic system comprising a portable communications control station and a  
3 remote data processing station. A portable communications controller is connected  
4 to a vehicle data terminal to obtain data from the vehicle's onboard computer.

5 U.S. Patents Nos. 4,975,847 and 5,065,023, both issued to Abe et al., teach  
6 motor vehicle diagnosis systems.

7 U.S. Patent No. 5,541,840, issued to Gurne et al. of Chrysler Corporation,  
8 teaches a hand-held automotive diagnostic service tool which can operate with a  
master station to monitor, display, and process vehicle data and diagnose fault  
conditions. Service manual pages can be displayed and parts ordered on-line.

U.S. Patent No. 5,533,093 teaches an automated troubleshooting mechanism  
incorporated into portable test and communications equipment for telephone lines.  
Work order manager software is employed.

U.S. Patent No. 4,916,441 teaches a hand-held pocket terminal having a  
display screen and bar code reader for use in conjunction with patient medical care.

Various aspects of interactive CRT touch panel displays are taught by U.S.  
17 Patent Nos. 4,449,186 (to Kelly et al.), 5,404,443 (to Hirata), 5,488,575 (to  
18 Danielson et al.), 5,499,707 (to Steury) 5,537,315 (to Mitcham) and 5,539,429  
19 (to Yano et al.). Such touch panels have been found useful in facilitating  
20 communications in a variety of customer service contexts.

21 The Super Advisor System marketed by Automatic Data Processing, Inc., of  
22 Hoffman Estates, Illinois, USA, allows Service advisors to use a hand-held, wireless

1 pen pad computer system to select or decline maintenance items displayed on the  
2 computer's screen and to describe vehicular problems via a series of checklists and  
3 multiple-choice questions. The system also provides customer appointment  
4 management, etc., using Microsoft Windows®.

5 One aspect of the present equipment service invention is to provide an  
6 efficient system and process for obtaining, recording and utilizing appropriate  
7 information about a vehicle and its required service from a customer.

Another aspect of the invention is to provide a system for obtaining such  
information without the need for the presence of a representative of the repair shop.

Yet another aspect of the invention is to provide a complete, concise, and  
readable repair/service order for the mechanic, parts suppliers, and customer.

These and other objectives are fulfilled by preprogrammed interactive  
computer systems for obtaining vehicle information, symptoms and requests from a  
customer, and developing work and parts orders. The system includes:

interactive input, display, computing and storage mechanisms for querying the  
customer, receiving inputs of information, and storing the provided information;

17 preprogrammed central computer processing unit(s) for ordering successive  
18 presentations of appropriate queries for the customer via the display means;

19 a compiler to summarize the inputs received and process the summary to  
20 generate a work and/or parts order; and at least one printer to print the work order  
21 for both the customer and mechanic, billing records, and reminders to the vehicle  
22 service and other personnel for future services.

1            Optionally, an input mechanism can be provided to transmit data upon  
2 completion of the work to an accounting module or subsystem to facilitate  
3 preparation of the bill and notification of the customer by the accounting department.  
4 Such data can also be transmitted to a quality control subsystem.

5            Further input and display mechanisms are provided for the mechanic to check  
6 and provide status information about the automobile's current service program. A  
7 data bank is provided to receive and maintain current status information on work  
8 assignments being performed for customers and cars. Interactive communication  
9 units are provided to originate and receive calls to and from customers regarding the  
10 status of the work assignments on their cars. Interactive communication units are  
11 also provided to initiate and execute orders for service, supplies, and parts from  
12 dealer stock or external providers.

13            Other components of the system include interactive computer monitor screens  
14 which identify relevant portions of the vehicle, the locations therein, and symptoms.  
15 Input mechanisms for the system include touch-activating monitor screens and  
16 keyboards. A database of scheduled and unscheduled periodic maintenance tasks  
17 for various types of vehicles serviced can be linked to the pertinent query screens.  
18 This database information can be provided at a distance by use of the Internet or  
19 locally through computer memory. Programmed query sets include the categories of  
20 engine/drivability, noise/vibrations, transmission, 2 and 4-wheel or more drive,  
21 heater/AC, brakes, steering/suspension, power accessories/electrical, and  
22 miscellaneous other services.

1 Further, an interactive computerized process is provided for receiving  
2 customer inputs for developing work orders for automobile repair and maintenance.

3 This is accomplished by steps including!

4 querying the customer and receiving inputs regarding the customer and  
5 automobile ID via computer input and output systems using Programmed sets of  
6 questions regarding specified vehicle systems and categories regarding the  
7 maintenance and/or repairs;

selecting the services which are requested and/or needed, including  
investigative work;

printing, storing and displaying work orders including the provided customer  
and vehicle ID and assigned services for both the customer and the assigned  
mechanics; and

printing reminders for use by the equipment owner or equipment service  
personnel relative to prior history, dates or usage mileposts requiring further service  
or bar-coded information for future reference.

## 17 BRIEF DESCRIPTION OF THE DRAWINGS

18 Like reference characters designate corresponding parts in the several views.

19 FIG. 1 provides a block diagram of the system, as it would be used at a typical  
20 automobile dealership or repair shop.

21 FIG. 2 is a master flow sheet illustrating the organization and operation of the  
22 system.

1 FIG. 3 illustrates a "customer service process" of using the system.

2 FIGS. 4-11 are queries for each of the subcategories of FIG. 2.

3 FIG. 4 is a flow sheet for the category 1, "Engine Drivability", problems.

4 FIG. 5 is a flow sheet for the category 2, "Noises/Vibrations", problems.

5 FIG. 6 is a typical flow sheet for the category 3, "Automatic/Manual/4 Wheel  
6 Drive", problems.

7 FIG. 7 is a flow sheet for category 4, "Heating/AC", problems.

8 FIG. 8 is a flow sheet for category 5, "Brakes", problems.

FIG. 9 is a flow sheet for category 6, "Steering/suspension", problems.

FIG. 10 is a flow sheet for category 7, "Power Accessories/Electrical",  
problems.

FIG. 11 is a flow sheet for the category 8, "Other Services".

FIGS. 12-21R are illustrative of computer screens useful for obtaining the  
information needed under categories 1-8.

FIG. 12A to 12G illustrate selected computer monitor screens for "Introductory  
Information."

7 FIG. 13 illustrates a computer monitor screen for the selection of pertinent  
18 categories.

19 FIGS. 14A to 14D illustrate computer monitor screens for the "subcategory 1"  
20 program.

21 FIGS. 15A to 15E illustrate computer monitor screens for the "subcategory 2"  
22 program.



1           FIGS. 16A to 16E illustrate selected computer monitor screens for the  
2 "subcategory 3" program.

3           FIGS. 17A to 17E illustrate selected computer monitor screens for the  
4 "subcategory 4" program.

5           FIGS. 18A to 18D illustrate selected computer monitor screens for the  
6 "subcategory 5" program.

7           FIGS. 19A to 19D illustrate selected computer monitor screens for the  
"subcategory 6" program.

          FIGS. 20A to 20F illustrate selected computer monitor screens for the  
"subcategory 7" program.

          FIGS. 21A to 21S illustrate selected computer screens for the "subcategory 8"  
program.

          FIGS. 22A to 22C illustrate selected computer screens for the "Additional  
Services" program.

          FIG. 23 illustrates a computer screen for addressing "Additional Problems."

          FIG. 24 illustrates a screen for "Unscheduled Services."

17          FIGS. 25A-26B illustrates screens asking for a review the "Repair Order."

18          FIG. 26 illustrates an "Estimated Repair Costs" screen.

19          FIG. 27 illustrates a "Designation of the Service Advisor and Cost Estimate"  
20 screen.

21          FIG. 28 illustrates a screen authorizing the repair work and acknowledges the  
22 criteria under which the repair is to be done.

1 FIG. 29 is illustrative of a screen providing instructions for the deposition of  
2 keys into a lockbox.

3 FIG. 30 illustrates a screen allowing a designation of whether the customer  
4 wishes to "Wait, Drop off the Car, or obtain a Loaner."

5 FIGS. 31A and 31B illustrate screens relating to the acceptance of the  
6 finished repair order.

7 FIG. 32 depicts the representative print-out of "Repair Order."

FIG. 33 is a portion of a typical flowsheet for the repair of other vehicles and  
equipment.

### **DESCRIPTION OF THE PREFERRED EMBODIMENTS**

FIGS. 1 and 2 provide an overview of the systems and methods of the  
invention. FIG. 1 is a system overview of the invention. A customer brings an  
automobile to the repair center where customer interacts with customer interview  
terminal screen 10. This console can include a portable personal computer or, at  
least, a freestanding terminal serving a master computer. It comprises input means  
and interactive display means, preferably a touch-active CRT screen such as  
disclosed in U.S. Patents Nos. 4,449,186; 5,404,443; 5,488,575; 5,499,707;  
5,537,315 and 5,539,429 incorporated herein by reference. Such touch-active  
screens preferably incorporate audio output means, as disclosed in U.S. Patent No.  
4,449,186. The system is designed so that the hardware and software cooperate to  
provide convenient means for the customer to provide the necessary information.

1 Preferably, most information will be provided via the touch-active screen in response  
2 to a menu-driven series of queries or prompts. Some of the input information (i.e.,  
3 vehicle and customer ID, credit card payment information, and the like) can be  
4 provided by inserting to the card reader 20 a credit card, or other identity card issued  
5 by the repair center to minimize effort on the part of the customer and errors as well.  
6 Such cards can be used to unlock and provide access to the console and other input  
7 devices to minimize vandalism or other unauthorized activities. Alternatively,  
8 systems can be used which automatically sense the vehicle's ID and/or the condition  
of the vehicle systems 40, see e.g., U.S. Patent No. 5,058,044. To augment the  
preferred touch-active screens, a standard or simplified alphanumeric keyboard 30  
can be provided, and optionally provisions can be made for the customer to dictate  
into the input system using devices such as the voice-activated system disclosed in  
U.S. Patent no. 5,586,037.

In addition to the Customer's direct input of ID data, observed symptoms, and  
requests at this intake transaction, customer may be assisted by a service advisor or  
other representative of the repair center. Such representatives may enter  
17 information at the console 10, and/or use a hand-held device such as disclosed  
18 above. Optionally, readings may be taken from the vehicle's onboard computer 50  
19 at this point using d hand-held unit or other computerized monitor. In this way, the  
20 error codes from the onboard computer can be read, analyzed, and considered in  
21 writing up the service order. This will normally be available only if the customer is  
22 willing to wait and there is a repair center representative available to take the

1 readings unless an automatic sensor system is used as in U.S. Patent No.  
2 5,557,268. A service advisor may introduce information into the system via console  
3 10, either during the customer's intake transaction or thereafter. Preferably, the  
4 service advisor will employ a hand-held unit incorporating the functions of console  
5 10.

6 The console displays menus, queries, prompts and input/output data on the  
7 CRT screen, and upon command or completion of the transaction prints out  
materials via printer 40 for the customer's use,

The information inputs all enter a central processing unit (CPU) 70 component  
of a computer where they are analyzed and correlated. The system may query the  
customer further to develop the input information fully before closing the transaction.  
When the initial information is obtained, the system prepares a service order, if the  
needed service and/or repairs are clear. If more information is needed to determine  
the Service required, the system can print out and display a proposed service order  
containing queries for the mechanic and/or service advisor to analyze. The service  
mission is subject to change after readings have been taken from the vehicle's  
onboard computer.

18 A finished service order will be transmitted to mechanic via printer 90 and/or  
19 console, which displays the order on a CRT screen. Using similar input means to  
20 those described for console 10, the mechanic can submit information to modify the  
21 service order, query the service advisor as to what work is approved, and advise the  
22 system when the job is completed or delayed. Such inputs will be transmitted to

1 CPU 70 which stores and processes them, Events including job completion or delay  
2 are transmitted via suitable communications media, such as the telephone, facsimile,  
3 or e-mail, to the customer using customer notification programs. Additionally, in the  
4 process of the job, the CPU can be used to optionally identify and order materials,  
5 spare parts and the like for the service using ordering program.

6 FIG. 2 is a master flow sheet illustrating the operation of the computerized  
7 process outlined in FIG. 1. To initiate the intake process, the customer approaches  
8 terminal 100. Information input can be by scanner, e.g., FIGS. 12A and 12B, or  
other means, e.g., a typewriter. Preferably, the information is generally input by use  
of a touch screen. Where a numeric input is needed, a keypad will appear, e.g., 12A  
and 12B. Where alphabetic and numeric information is needed, an alphanumeric  
keypad will appear, e.g., 12C. Specific information is input into the computer of a  
preferred hand-held unit by stylus pressure on a square, e.g., FIG 13E; a dot, e.g.,  
13F, a circle, e.g., 13G. Basic ID, and, where selected, credit card information can  
be provided via an ID card reader 105 and/or submitted via touch-active screen or  
keyboard. The information provided appears on display 110 which provides  
17 correction prompts or queries. For example, if the current vehicle mileage and  
18 phone contact information are not provided initially, they can be submitted upon  
19 request as at 115 and 120. When the necessary intake information is provided, the  
20 display shifts to the main menu 125 which offers multiple choices as well as a "Help"  
21 function. In FIG. 2, the main menu categories include the Engine/drivability (1),  
22 Noise/vibrations (2), Automatic/manual/4-wheel Drive Transmission (3), Heater/AC

1 (4), Brakes (5), Steering/suspension (6) Power accessories/electrical (7), and Other  
2 services (8) subcategories. These categories are supplemented (See Fig. 32) for  
3 vehicles more complex than automobiles, e.g., a Peterbilt truck, and vehicle-based  
4 equipment, e.g., a cherry picker and a front loader. Each of these menu choices  
5 leads to subroutines containing multiple menu choices to guide the customer through  
6 an interrogation process which will identify the problems to be corrected and/or  
7 routine services to be performed. Exemplary flow diagrams for these subcategories  
are provided in subsequent figures discussed below. Upon completion of any of the  
subroutines 1 through 8, the display shifts to a "General Questions" subroutine 130  
which queries the customer as to how often the problem occurs and similar  
questions. After responding to these queries, the customer is queried as to whether  
there are additional vehicle problems 135; if "yes", the program reverts to the main  
menu for further choices. Selection of the "other services" menu 140 provides  
options for choosing various maintenance services as well as a "Help" option which  
refers the customer to the service advisor as shown at 145.

Upon completion of the interrogation via the categorical subroutines, the  
customer is automatically transferred to "Additional Services" subroutine 150, which  
18 offers further choices discussed below for routine service operations and the like.  
19 When the customer has finished with this subroutine, customer is transferred to an  
20 additional services menu 150 which offers additional service options. Once the  
21 customer exits this menu, customer is transferred to subroutine 155 which uses  
22 Boolean and other processing logic to provide a compilation of the symptoms and

1 requested service items and displays the compilation along with a menu of additional  
2 accessories or services which can be purchased. Following this, subroutine 160  
3 provides a cost estimate of any requested maintenance services, and subroutine  
4 165 provides a cost estimate of repair costs and pickup time. The repair/work order  
5 is presented by subroutine 170, and the customer's electronic signature is captured.  
6 On signature of the repair order, instructions for leaving the key(s) in a secure  
7 depository are shown at 173. Subroutine 175 then queries whether the customer will  
8 wait for the vehicle, drop it off, or request a loaner vehicle. This subroutine also  
queries the customer's requests with regard to the disposition of the used parts.  
Finally, the finished repair estimate is displayed and printed out for both the  
customer, service advisor and the mechanic, at 180.

FIG. 3 illustrates a customer's interaction with the system. As in FIG. 2, a  
customer interacts with blocks 300, 305, 310, 315, 320, and is transferred to main  
menu 325. Category 1 Engine/drivability is selected by the customer at 330 and  
menus are presented as in FIG. 4. The customer is exposed to a succession of  
computer monitor screens in the course of selecting from the menu, as illustrated in  
FIGS. 12A to 12G. As shown in FIG. 3, the customer selects the "Symptoms when  
starting category at 335, and thereafter is called upon to describe the symptoms at  
340 and when they occur at 345. After the selection of the latter, the system  
transfers to the "General questions", subroutine 350. After this question is  
answered, the system transfers to the "Additional vehicle problems", subroutine 355.  
In this case, the customer selects "NO", and is transferred to the "additional

1 services" menu 360. Since the customer chooses no additional services, the system  
2 analyzes the symptoms and any requested maintenance services at 365 and  
3 presents the customer with a menu of additional merchandise and services which  
4 can be purchased. Subroutine 370 presents the customer with the estimated  
5 maintenance costs (if any), and subroutine 375 presents a statement of estimated  
6 repair costs and pickup time. The system then captures the customer's signature  
7 380, queries as to whether customer will wait or drop off the vehicle 385 with the  
repair organization, whether a loaner is required, and whether parts are to be  
returned as shown in block 385. Finally, the finished repair order is displayed and  
printed for both customer and mechanic at 390.

FIG. 4 illustrates the operation of the "Engine/drivability" menu (category 1).  
The customer is initially presented with a choice as to describing symptoms which  
occur when starting or driving, or "Other symptoms". Given any of these three  
choices, the customer is asked to describe the nature of the symptoms, then queried  
to describe when the symptoms occur. Optionally, inputs from the service computer  
can be provided at this point to provide further information on the nature of the  
symptoms and when they occur. After these questions are answered, the subroutine  
transitions to a "General Questions" subroutine to describe 'how often the symptoms  
occur. From General Questions, the customer selects whether or not there are  
Additional Vehicle Problems. If none, customer proceeds to Additional Services; if  
"yes" is answered, customer is returned to the Main Menu to make another choice,



FIG. 5 illustrates the menu choices for "Noise/vibrations" (Category 2). The initial menu allows the customer to select noises or vibrations alone or a combination of both. Whatever the choice, the customer will be queried as to what the nature of the symptoms are, when they occur and where the symptom occurs. Input from the service computer can be provided to assist in the analysis. Finally, the customer is queried as to "how often" the symptoms occur. At this point, the computer advances to "Additional Vehicles Problems" 135.

FIG. 6. Illustrates menu choices for a "Automatic/manual/4-wheel drive" transmission check (Category 3). The initial menu requires selection as to automatic or manual transmissions or the 4-wheel drive. Once a selection is made, the customer is queried as to the nature of the symptoms and when they occur. These questions answered, the customer is queried as to how often the symptoms occur. After all these questions are answered for a subcategory, the customer is queried as to whether there are problems in another subcategory. If not, the system moves to the closing sequence. If the customer indicates that there are problems in another subcategory, (e.g., problems with the 4-wheel drive in addition to the transmission), the computer returns to the main menu 125 for another selection.

FIG. 7 illustrates the operation of the menu for "Heating/Air Conditioning" (Category 4). The initial menu selections are for symptoms of heating, air conditioning or automatic temperature control. Once a subcategory is selected, the customer is again called upon to describe the nature of the symptoms and when they occur. These questions answered, the system transitions to "General Questions"

1 including how often the symptoms occur. After these questions are answered, the  
2 customer is called upon to declare whether there are additional problems in other  
3 subcategories. If not, the closing sequence is actuated. If so, customer is returned  
4 to the menu 125 to make another selection.

5 FIG. 8 illustrates the menu choices for "Brakes" (Category 5). The initial  
6 menu selections are for conventional brakes, anti-lock brake systems, or  
7 combinations of both. As in the other categories, the customer is called upon to  
8 describe the nature of the symptoms, when they occur, and how often they occur  
before returning to the main menu or going through the closing sequence.

FIG. 9 illustrates the menu choices for "Steering/Suspension" (Category 6).  
The initial menu choices are for steering or suspension problems, and after making a  
selection, the customer is called upon to describe the nature of the symptoms, when  
they occur, and how often they occur. After these questions are answered, the  
customer is queried whether there are any symptoms in the other subcategory (e.g.,  
suspension in addition to steering). If not, customer is returned to the main menu or  
passed through the closing sequence.

7 FIG. 10 illustrates the menu choices for "Power Accessories/Electrical"  
18 (Category 7). The initial menu choices are for electrically operated components and  
19 power accessories, and once a selection is made, the customer is queried as to the  
20 nature of the symptoms, when they occur, and where they occur. Once these  
21 questions are answered, the customer is queried as to how often the symptoms  
22 occur. Upon completion of these questions, the customer is queried as to whether

1 symptoms exist in another subcategory. If not, the customer is returned to the main  
2 menu or to the closing sequence.

3 FIG. 11 illustrates the menu operation for "Other" problems (Category 8). The  
4 initial menu choices are scheduled and unscheduled maintenance, i.e. maintenance  
5 which is conducted at predetermined total mileage figures or at periodic mileage/time  
6 intervals. Once selections are made for any required maintenance in these  
7 subcategories, the system queries the customer regarding "Additional Vehicle  
Problems". Subcategories 3 and 4 provide menu choices regarding problems with  
the vehicle exterior and interior. Having selected one of these subcategories, the  
customer is queried as to the nature of the symptoms, when they occur, and where  
they occur before being asked general questions including how often they occur.  
When queries and answers for each subcategory are completed, the customer is  
queried as to whether problems/symptoms exist in other subcategories. If so,  
customer is returned to the main menu for another selection or progresses through  
closing sequence. Subcategory 5 covers special orders or parts and recall notice  
items. Subcategory 6 deals with new or used-car problems. In subcategory 7,  
"General Symptoms", the customer is again called upon to describe the nature of the  
18 symptoms, when they occur, and where they occur then how often the symptoms  
19 occur.

20 FIGS. 12A and 12B illustrate computer screens which relate to information  
21 obtained by optic, magnetic or rf (including microwave) scanning. FIGS. 12C-12D  
22 illustrate screens which enable the customer to input personal information. FIGS.

1 12E and 12F are illustrative of screens enabling the customer to input "Mileage" by  
2 pressing a "change" designator to bring up a numeric keypad. FIG. 12G similarly  
3 enables the customer to enter a telephone number for contact during the period the  
4 car is in the shop. An illustrative keypad screen is omitted.

5 FIG. 13 illustrates screens for the selection of one or more repair categories.  
6 Category 1, "Engine/Drivability" has been selected as indicated by the outline  
7 around that category.

FIGS. 14A to 14E illustrate computer monitor screens for the "Category 1"  
program. FIG. 14A identifies the category and asks for the selection of "Symptoms."  
FIG. 14B illustrates a screen for "Symptoms when starting." FIG. 14C illustrates the  
screen for "When do you notice it", i.e., the questions about the nature and  
frequency of the symptoms. FIG 14D illustrates the screen querying the customer  
regarding "Symptoms when driving".

FIGS. 15A to 15E illustrate selected computer monitor screens for "Noises  
and Vibrations", the Category 2, program. FIG. 15A illustrates a computer screen  
representing the selection of the "Noise or Vibration" category, including selections  
for noises and/or vibrations. FIG. 15B illustrates a screen representing the selection  
of the "Noise information" subcategory. FIG. 15C illustrates the screen presenting  
the query "Where is it coming from?" via a diagram. FIG. 15D illustrates a screen  
querying "When does it happen" containing generic questions pertaining to noises  
and/or vibrations. FIG. 15E illustrates the screen requiring the selection of  
vibrational categories. "Shudder" has been selected.

FIGS. 16A to 16E illustrate selected computer monitor screens for a Category 3, "Automatic/Manual/4 Wheel Drive Transmission" program.

FIG. 16A illustrates the computer screen for the category of "Transmission" information, offering choices for automatic or manual transmissions or an exemplary 4-wheel drive. FIG. 16B illustrates the screen for the "Automatic transmission" subcategory offering choices as to types of symptoms observed. FIG. 16C illustrates the screen for the "Manual transmission" subcategory, offering choices of various symptoms observed. FIG. 16D illustrates a screen for "4-wheel drive transmissions" subcategory offering choices as to various symptoms observed. FIG. 16E illustrates a screen querying "When does it happen", with a set of generic questions applicable to any of the subcategories.

FIGS. 17A to 17E illustrate selected computer monitor screens for the category 4, "Heater/AC" program. FIG. 17A illustrates the computer screen for defining the Heating or Air Conditioning problem. FIG. 17B illustrates a screen for the "Heating" category. FIG. 17C illustrates a screen for the "Air Conditioning" category. FIG. 17D illustrates a screen for the automatic temperature control system. FIG. 17E illustrates a screen providing questions as to "When does it happen."

FIGS. 18A to 18D illustrate selected computer monitor screens for the category 5 "Brakes" program. FIG. 18A illustrates a computer screen for defining the particular brake system. FIG. 18B illustrates a screen for defining the problem with a conventional braking system. FIG. 18C illustrates a screen for defining problems

1 with regard to an anti-lock braking system. FIG. 18D illustrates a screen querying  
2 "When does it happen."

3 FIGS. 19A to 19D illustrate selected computer monitor screens for the  
4 category 6, "Steering and Suspension" program. FIG. 19A illustrates a computer  
5 screen for defining whether the problem relates to steering or suspension. FIG. 19B  
6 illustrates the screen for the "Steering information" subcategory including questions  
7 regarding various symptoms observed with regard to the steering. FIG. 19C  
illustrates the screen for the "suspension" subcategory, including questions  
regarding various symptoms observed. FIG. 19D illustrates the screen for "When  
does it happen" including questions regarding the operating modes and speed when  
either steering or suspension symptoms occur.

FIGS. 20A to 20F illustrate selected computer monitor screens for the  
"Electrical" program. FIG. 20A illustrates a computer screen offering choices of  
problems connected with "electrically operated components" or "power accessories".  
FIG. 20B illustrates a screen which includes questions regarding the specific  
components requiring service. FIG. 20C illustrates a screen including questions  
17 regarding "Power accessories" where the symptoms are observed. FIG. 20D  
18 illustrates a screen for narrowing the search terms. FIG. 20E illustrates the screen  
19 for "When does it happen". FIG 20F illustrates a screen for identifying the area  
20 where the problem is located.

21 FIGS. 21A to 21L1 illustrate selected computer screens for the "Other  
22 services" program. FIG. 21A illustrates a screen for "Other services available"

1 offering menu choices for scheduled and unscheduled maintenance, vehicle exterior  
2 and interior, special order parts and recall notices, new- or used-car internal and  
3 general symptoms. FIG. 21B illustrates a screen for "Unscheduled maintenance"  
4 and FIG. 21C illustrates a screen for "Vehicle exterior" subcategory including  
5 questions regarding the area(s) in which the problem is occurring. FIG 21D provides  
6 problem location selections. FIG. 21E illustrates a screen requesting information on  
7 the problem description. The FIG. 21F illustrates a screen for locating a problem on  
the vehicle exterior via a diagram. FIG. 21G illustrates a computer screen for the  
'Vehicle interior' subcategory, including questions regarding the area where the  
problem is occurring. FIG. 21H illustrates a screen for the "Problem location"  
subcategory of 'Vehicle interior lighting'. FIG. 21I is illustrative of a screen for  
locating problems via a diagram. FIG. 21J illustrates a screen for describing the  
problem in the vehicle interior. FIG 21K illustrates a screen for information regarding  
a special order or recall notice. FIG. 21L illustrates the screen for a "new car" or  
"used car" internal repair order. FIGS. 21M – 21S illustrate screens for identifying  
things the customer sees, hears, smells and feels under the "help" category 140 of  
FIG. 2 and asks "When" and "Where."

18 FIGS. 22A to 22D illustrate selected computer screens for "General  
19 Questions, Other Symptoms and Return Problems."

20 FIG. 23A illustrates an "Additional problems" screen.

21 FIG. 24 illustrates a screen for selecting "Unscheduled services" and includes  
22 prices for those services.

1           FIGS. 25A and 25B are screens requesting that the customer review the  
2 previously input material.

3           FIGS. 26 and 27 illustrate screens for providing an estimate of cost and pick-  
4 up time.

5           FIG. 28 illustrates a screen for acknowledgment and capture of customer  
6 signature. This corresponds to block 170 on FIG. 2.

7           FIG. 29 illustrates a screen instructing the customer to deposit the vehicle  
keys in an appropriate lockbox.

          FIG. 30 illustrates a screen for selection of "wait", "drop off", or a "loaner."

          FIGS 31A and 31B illustrate "Repair order acceptance" screens. This  
corresponds to block 180 of FIG. 2.

          FIG. 32 illustrates the "Repair order generated" screen including the captured  
customer signature.

          FIG. 33 illustrates the additional categories 9 and 10 of a Master Flow Sheet  
extending FIG. 2 for various types of vehicular equipment.

## 17                           **GENERAL DESCRIPTION OF THE INVENTION**

18           Various combinations of commercially available computer hardware can be  
19 used to assemble the systems of the invention. Computer support can range from a  
20 single personal computer or microcomputer to a master computer with multiple  
21 terminals. Portable or hand-held terminals or computers can be used to facilitate the  
22 collection and transmission of data. The computer support mechanisms preferably



1 include a central processing unit, at least one compiler, data storage devices  
2 including disk drives and the like, at least one monitor with display screen, a modem,  
3 an interactive media device and input/output mechanisms. The computer system is  
4 configured, as required, by the particular programs to be run with capacities and  
5 rates suitable to provide reasonable response times.

6 Input mechanisms can include conventional keyboards and/or keypads,  
7 interactive touch screens, and screens with icons responsive to a "mouse", optical  
and magnetic readers, and data input ports. Preferably the input mechanisms  
include touch-active display screens as discussed in detail below. Such screens  
permit interaction between a user and the computer in response to the user's  
touching the screen with an object such as a finger or a pointing device. As  
disclosed in U.S. Patent No. 5,537,315, such pointing devices can include a light  
pen, sonic pen, voltage pencil, stick, or wand. Other input mechanisms to the  
system, if not directly to the computer, will include conventional credit card readers  
for receiving data about the customer and/or vehicle to be serviced, plus payment  
information such as credit card numbers. One suitable credit card reader is  
disclosed in U.S. Patent No. 4,449,186, column 1. Optionally, the input mechanisms  
18 can include a voice-activated system, such as a digitized voice recognition system  
19 for receiving user input, such as those pioneered by Dragon Systems, Inc., San  
20 Rafael, California.

21 The computer support mechanisms preferably include at least one hand-held  
22 or portable terminal which permits data to be input to the system vial a keypad or

1 keyboard or equivalent device. This will permit a service advisor and/or mechanic to  
2 receive and input data conveniently from the vehicle. Such terminals have become  
3 commonly available and can be designed or purchased and modified to interface  
4 with the system. A representative example of such terminals is found in U.S. Patent  
5 No. 5,468,575.

6 Since most contemporary automotive vehicles include onboard computers  
7 which receive information from sensors, control various systems via actuators, and  
record various failures of equipment, input mechanisms for the system should  
include mechanisms for reading and analyzing data from such onboard computers.  
Any suitable mechanism can be used which allows such data to be read, analyzed,  
and input to the computer of the system. One example is the "hand-held automotive  
diagnostic service tool", of U.S. Patent No. 5,541,840, which is incorporated herein  
by reference. As disclosed in U.S. Patent No. 4,602,127, many modern vehicles  
include mechanisms for obtaining direct access to the data of such onboard  
computers on a real-time basis. Inputs to the system can also be provided by  
automatic vehicle recognition and diagnostic systems such as those disclosed in  
17 U.S. Patent No. 5,557,268.

18 Output mechanisms can include display mechanisms, such as the CRT  
19 display screens of computer monitors, printers, and program-actuated facsimile,  
20 credit checking devices, and/or telephone devices. The printer(s) can be any  
21 suitable unit(s) selected from commercially available models such as laser or ink jet  
22 printers.

1 Computer programs or software subsystems or modules are used to carry out  
2 various tasks for which the systems are employed. Many of these subsystems can  
3 be obtained or modified from existing commercial programs. In any case, the  
4 required programs can readily be provided by those of ordinary skill in the art in view  
5 of the teachings herein. For instance, accounting and billing programs are readily  
6 available and can be obtained or modified to provide a statement of account for  
7 services performed. Programs for receiving and analyzing the data stored in vehicle  
onboard computers are also available. However, the most important part of the  
diagnostic process will still generally be the analysis by the mechanic and/or service  
manager of the information provided by such programs and the vehicle driver.  
Service order-writing programs are generally available; see, e.g., U.S. Patent No.  
5,058,044,

8 Programs to generate and/or access a service record for the vehicle(s)  
9 serviced are also available. Technical library or database programs can be used to  
10 provide access to scheduled and unscheduled maintenance operations, service and  
11 parts manuals for the mechanic as well as the customer. Programs for identifying  
12 and ordering parts are also available. However, such programs will generally be  
13 tailored or prepared especially for users of the particular systems of the invention.

14 The figures provide an exemplary mechanism for obtaining the vehicle driver's  
15 input. They do not include a listing of all possible options with respect to  
16 automobiles. The additional categories 9 for "Mechanical" and 10 for "Hydraulic or  
17 Pneumatic" systems will include the "What", "Where", and "When" questions of the

1 previous categories and will provide feedback subroutines necessary to handle  
2 vehicles other than automobiles and mechanical equipment for grading, lifting,  
3 moving, etc., various items and/or products. .